NON-PUBLIC?: N
ACCESSION #: 8909060289
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Clinton Power Station PAGE: 1 OF 09

DOCKET NUMBER: 05000461

TITLE: Failure to Match Manual Control to Automatic Control Prior to Transferring Feedwater Pump to Manual Results in Increase in Reactor Water Level and Manual Scram
EVENT DATE: 07/31/89 LER #: 89-032-00 REPORT DATE: 08/30/89

OPERATING MODE: 1 POWER LEVEL: 025

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: D. R. Morris, Director - TELEPHONE: (217) 935-8881
Plant Operations, extension 3205

COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: SN COMPONENT: V MANUFACTURER: F130
X SJ RV C710
X SN TD F130
X SB 84 F130

REPORTABLE NPRDS: N
N
N
N

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On July 31, 1989, with the plant at approximately 25 percent power, operators initiated a manual scram of the reactor. Prior to the scram, the plant had been operating at 100 percent power when difficulties were experienced with the moisture separator reheater (MSR) and the high pressure feedwater heater systems and their vent and drain system. In response to these difficulties, operators began reducing power to remove the MSRs from service. At this point, operators noted an increase in water level in the reheater drain tank, an increase in off-gas system flow, and a decrease in the main condenser

vacuum. In response, operators continued to decrease reactor power. At approximately twenty-five percent reactor power, while removing one of the turbine driven reactor feedwater pumps from service, an operator failed to match the manual feedwater control to the automatic feedwater control prior to transferring the pump to manual. This caused reactor water level to increase and approach the high water level scram setpoint therefore, operators initiated a manual scram. The cause of this event is attributed to operator error during the transfer of feedwater pump control. Because the operator recognized his error and identified it to his supervision, no corrective action is required. The system difficulties experienced prior to the scram have been addressed.

END OF ABSTRACT

DESCRIPTION OF EVENT

On July 31, 1989, with the plant in Mode 1 (POWER OPERATION), at approximately ninety-three percent reactor RCT! power, main condenser COND! vacuum SH! began decreasing. In response to this, plant operators began reducing reactor power. During this power reduction, reactor pressure vessel RPV! water level began to increase and approached the Level 8, high water level, scram setpoint. In response to the increasing water level, plant operators placed the reactor mode switch HS! in the shutdown position initiating a manual reactor scram.

At approximately 0300 hours on July 27, 1989, an operator was attempting to place the Moisture Separator Reheaters MSR! in service in the manual mode. During this attempt, the "A" MSR exhibited normal behavior but a large demand signal was required to open the steam supply valves V!, 1B21-RSHLV-1 and 1B21-RSLLV-1, to the reheater of the "B" MSR. In response to the large demand signal, the steam supply valves opened rapidly. As a result, pressure in the "B" MSR reheater increased suddenly to equal main steam SB! pressure, 950 pounds per square inch gauge (psig). When the operator noticed the large surge in pressure, he reduced the demand signal and terminated the attempt to place the MSRs in service.

An investigation performed after this event determined that the sudden increase of pressure in the "B" MSR reheater occurred because both steam supply valves, 1B21-RSHLV-1 and 1B21-RSLLV-1, to the reheater of the "B" MSR incorrectly opened at the same time causing a high pressure steam surge to the "B" MSR. By design, the "low load" valve, 1B21-RSLLV-1, opens first to gradually ramp up steam flow and pressure to prevent a large steam surge to the "B" MSR reheater, After the "low load" valve opens, the "high load" valve, 1B21-RSHLV-1, opens to provide full steam flow.

The sudden increase of pressure in the "B" MSR reheater resulted in a large pressure transient in the "B" MSR Reheater Drain Tank TK! SN! (RHDT) and the Normal Drain Valve, 1HD012B, of the "B" MSR RHDT. Illinois Power Company (IP) believes that this transient damaged the cast iron yoke of the Normal Drain Valve.

At approximately 2345 hours on July 27, the MSRs were placed in service. At this time, the Normal Drain Valve, 1HD012B of the "B" MSR RHDT would not pass flow to the "6B" Reactor Feedwater SJ! High Pressure Heater as required for maintenance of level in the RHDT (IP believes that the failure to pass flow was caused by the damage to the yoke of the valve 1HD012B or by the check valve 1HD010B, located between the "B" RHDT and Normal Drain Valve 1HD012B, being stuck closed.) Operators noticed this because the demand position indication for the Normal Drain Valve indicated that the valve was receiving a signal to fully open but the level in the RHDT was increasing.

Because the Normal Drain Valve was not properly controlling level in the automatic control mode, operators placed the control for the Normal Drain Valve in manual, at twenty percent open, and used the Emergency Drain Valve, 1HD021B, of the "B" RHDT in automatic to control level in the "B" RHDT.

On July 28, 1989, level in the "B" RHDT decreased and therefore operators assumed (incorrectly) that check valve 1HD010B had opened and that the Normal Drain Valve would begin controlling level (the damage to the yoke of Normal Drain Valve had not yet been identified). For this reason, operators then placed the Normal Drain Valve in the automatic mode. In this mode, the demand position indication for the Normal Drain Valve indicated closed because the level in the "B" RHDT was low. At this point, operators left the Emergency Drain Valve and the Normal Drain Valve in the automatic control mode and continued to increase reactor power.

On July 28 and July 29, 1989, level in the "B" RHDT remained low.

On July 30, 1989, because level in the "B" RHDT was low, operators suspected that the "B" RHDT Emergency Drain Valve was passing flow even though the demand signal to this valve was for full closed. As a result, at approximately 1400 hours, operators placed the controller for the "B" RHDT Emergency Drain Valve in manual and signaled the valve to close so that level in the "B" RHDT could be restored. In response to the signal to close, the valve appeared to close more than it did with the controller in automatic. Operators then placed the controller for the Emergency Drain Valve in automatic, the valve opened partially, and the Emergency Drain Valve Not Full Closed annunciator ANN! alarmed. This was followed by a complete loss

of level in the "B" RHDT. Since the Emergency Drain Valve was open, the "B" RHDT was open to the main condenser, therefore, team flow indication in the "B" MSR Reheater indicated high offscale. At this point, the Emergency Drain Valve would not respond to a close signal.

An investigation during this event identified that the Emergency Drain Valve would not respond to the close signals because the valve's controller TD! had an air leak. In response to this, operators placed the Emergency Drain Valve in manual control and closed the valve. Control for the Normal Drain Valve was left in automatic and was providing a close signal to this valve.

Further investigation performed after this event determined that the sudden diversion of steam flow from the "B" RHDT to the main condenser probably backseated the check valve, 1HD010B, located between the "B" RHDT and Normal Drain Valve 1HD012B. IP believes that the backseating of check valve 1HD010B caused water hammer on the Normal Drain Valve 1HD012B and resulted in a complete failure of the Normal Drain Valve in the open position.

Since steam flow was diverted to the main condenser, the scavenging steam controller sensed high flow in the steam supply to the "B" MSR reheater. As a result, the scavenging steam valves opened fully to maintain maximum scavenging steam flow to the "6B" Reactor Feedwater High Pressure Heater (heater) HX!. This caused the "6B" heater to pressurize and resulted in two of the three relief valves RV!, 1DV032A and 1DV032B, of the "6B" heater, opening to relieve pressure. IP believes that, at this time, the bellows of relief valves 1DV032A and 1DV032B were damaged resulting in their failure. (Note: The failure of the bellows of these relief valves provides a path for air inleakage to the main condenser when these valves are closed.)

At 2118 hours, reactor power reached 100 percent of Rated Thermal Power (RTP).

On July 31, 1989, at 1920 hours, because the relief valves of the "6B" heater were cycling and since a replacement controller for the "B" RHDT Emergency Drain Valve was available, the Shift Supervisor decided to fully open the Emergency Drain Valve and to replace the controller.

At 2000 hours, replacement of the controller for the Emergency Drain Valve was complete. Operators then attempted to restore level in the "B n RHDT by closing the Emergency Drain Valve and by routing MSR scavenging steam to the main condenser. By 2040 hours, the Emergency Drain Valve was fully closed. At this point, water level in the "B" RHDT was still off-scale low.

At 2045 hours, operators discovered MSR/"B" RHDT scavenging steam valve

1HD106B to the main condenser in the full open position rather than its normal position. Operators suspected that the controller for the scavenging steam valve failed.

At 2050 hours, operators placed the control of the scavenging steam valve in manual and began closing the valve. By 2102 hours, the valve was closed.

Operators observed that the cycling of the relief valves of the "6B" heater stopped when the scavenging steam valve was closed.

Since water level in the "B" RHDT was zero, even though all outlets from the tank were closed, operators decided to remove the MSRs from service so that the system could be stabilized and so that level in the "B" RHDT could be recovered when the MSRs were returned to service.

At 2103 hours, operators began reducing reactor power to ninety-three percent in preparation for removing the MSRs from service.

Investigation performed after this event determined that following the replacement of the controller for the Emergency Drain Valve, this valve was closed resulting in a diversion of all "B" RHDT steam flow to the "6B" heater through the Normal Drain Valve 1HD012B. This caused the "6B" heater shell to pressurize and the relief valves of the heater to open. An engineering analysis determined that the bellows of the relief valves on the "6B" heater are undersized and therefore when the "6B" heater shell pressure increased, the bellows failed.

At 2130 hours, main condenser vacuum was 26.8 inches of mercury.

At 2140 hours, while removing MSRs from service, water level in the "B" RHDT began to increase, off-gas WF! flow increased to greater than 200 standard cubic feet per minute (scfm), and main condenser vacuum began to decrease. In response, operators began further reduction of reactor power by reducing Reactor Recirculation System (RR) AD! flow, and then attempted unsuccessfully to restore the MSRs to service.

At 2218 and 2220 hours, operators further reduced reactor power by inserting control rods.

Between 2221 and 2228 hours, off-gas flow decreased from 150 to 115 scfm and condenser vacuum decreased from 24.1 to 23.3 inches of mercury. In response to this, operators inserted more control rods to further reduce reactor power.

At 2229 hours, RR flow control valves FCV! were at the minimum position, therefore, operators down-shifted the RR pumps P! to slow speed. At this point, reactor power was approximately twenty-seven percent of RTP.

At 2230 hours, off-gas flow was 110 scfm and vacuum was 23.4 inches of mercury.

Investigation performed after this event determined that as operators reduced power to remove the MSRs from service, pressure in the "6B" heater decreased and the relief valves closed. When the relief valves closed, an inleakage path was provided from atmosphere to the main condenser through the vent holes located in the relief valve spring housings and through the damaged bellows. This inleakage path caused condenser vacuum to begin decreasing. Because of the inleakage through the vent holes, off-gas flow increased to 200 scfm and blew the water out of the loop seal SEAL) on the Steam Jet Air Ejectors (SJAE) EJR! intercondenser. This diverted about 100 scfm of the off-gas flow back to the main condenser and resulted in a decrease of off-gas flow to about 100 scfm. The loop seal failure caused SJAE performance to degrade and resulted in a continuous decrease of main condenser vacuum.

At 2236 hours, to maintain water level in the RPV, a control room operator transferred the control of the "B" Turbine TRB!-Driven Reactor Feedwater Pump from automatic to manual. The operator erred in the transfer and this error caused water level in the RPV to increase. Details of this operator error are provided in the CAUSE OF EVENT/CORRECTIVE ACTION section of this LER.

At 2237 hours, operators manually tripped the main turbine TRB!.

At 2238 hours, with the plant at approximately twenty-five percent of RTP, operators placed the reactor mode switch in the shutdown position initiating a manual reactor scram because RPV water level (at forty-eight inches) was approaching the Level 8 (fifty-two inches), high water level, scram setpoint. At this point, condenser vacuum was 22.7 inches of mercury.

Following this event, investigation identified that the travel pin of the valve positioner for steam supply valve 1B21-RSLLV-1 was broken and that the travel pin of the valve positioner for steam supply valve 1B21-RSLLV-2 was missing. The broken/missing pins would prevent feedback of valve position to the positioner. These pins were replaced under Preventive Maintenance activity PCIMSM037 (initiated 08/02/89). Investigation also identified that the two air relays RLY! inside the valve positioner for steam supply valve 1B21-RSHLV-1 would not change position to admit full actuator pressure and to provide a vent path for displaced actuator air. These relays were

replaced under MWR D08750. A calibration of the control circuit for the "A" and "B" MSRs was performed under Preventive Maintenance activity PCIMSM037.

Additionally, the steam supply valves for the MSRs will be inspected for damage under Maintenance Work Requests (MWRs) D10694, D10692, D14094, and D05972 during the plant's second refueling outage.

The cast iron yoke of the "B" RHDT Normal Drain Valve, 1HD012B, was replaced with a steel yoke and the internals of this valve were inspected for damage and replaced under MWR D13772. Additionally, as a precautionary measure, the cast iron yoke on the "A" RHDT Normal Drain Valve, 1HD012A, was replaced with a steel yoke under MWR D06540.

Proper operation of the normal and emergency drain valves was verified by cycling the valves while operators observed the operation and local indication.

Because steam flow through check valves 1HD010A and 1HD010B is insufficient to maintain the valve discs fully open, the discs flutter and cause pressure surges that have the potential for steam flashing and water hammer. An engineering evaluation was subsequently performed which determined that the internals of the check valves could be removed without adversely impacting system performance. Therefore, the internals

of the "A" and "B" RHDT to normal drain check valves 1HD010A and 1HD010B were removed under MWRs D14091 and D04055.

The bellows of the "6B" heater relief valves, 1DV032A and 1DV032B, were replaced under MWR D14289 with bellows of the same design because bellows of an enhanced design were not available. When bellows of an enhanced design become available, they will be installed in the relief valves of the "6A" and "6B" heaters under the plant modification program during a plant outage. To prevent pressurization of the "6A" and "6B" heaters and subsequent lifting of relief valves for the interim, IP has implemented temporary modifications which installed travel stops on the "A" and "B" RHDT Normal Drain Valves and installed check valves on the vent holes of the "6A" and "6B" heater relief valves.

The travel stops were installed under Temporary Modification 89-050. These stops will limit the full open position of the Normal Drain Valves to 500,000 pounds of steam per hour. This limitation will prevent pressurization of the feedwater heaters and damage to relief valve bellows if a failure of a normal drain valve occurs.

The check valves were installed on the vent holes of relief valves of the "6A" and "6B" heaters under Temporary Modification 89-049 and MWR D05798. These check valves will prevent a loss of condenser vacuum through the vent holes of the relief valves of the "6A" and "6B" heaters in the event of failure of relief valve bellows.

The bellows of other relief valves that communicate with the main condenser were leak tested with helium to determine if other bellows had failed. As a result, the bellows of one additional relief valve, "3A" reactor feedwater low pressure heater relief valve 1DV042A, were found damaged. Because spare bellows were not available for this valve, the vent hole of the valve was fitted with a check valve and the relief setpoint of the valve was lowered. This work was completed under MWR D14049 and Temporary Modification 89-051.

The loop seal of the SJAE is refilled during system startup under system operating procedure 3215.01, Off-Gas.

Proper operation of the scavenging steam controller for the "B" MSR was verified under MWR D08369. Under this MWR, a loop calibration was performed and the operation of the controller was found to be satisfactory.

MSR system operating procedure 3106.01, Moisture Separator Reheater, was reviewed and determined to be adequa
e.

To ensure that significant leaks in the main condenser system had been identified and corrected, a vacuum-drop test was performed on the condenser. This test was performed under system operating procedure 3813.10, Condenser Vacuum Drop Test. Evaluation of results of this test determined that no significant leaks exist in the main condenser system.

Following this event, the Radiation Protection and Chemistry departments reported no abnormal readings, indicating that no fuel damage occurred during this event.

No other automatic or manually initiated safety system responses were necessary to place the plant in a safe and stable condition. No other equipment or components were inoperable at the start of this event such that their inoperable condition contributed to this event.

CAUSE OF EVENT/CORRECTIVE ACTION

The cause of this event, the manual scram of the reactor, is attributed to

personnel error by a utility licensed operator.

On July 31, 1989, at 2236 hours, while in the process of transferring the "B" Turbine Driven Reactor Feedwater Pump (TDRFP) from automatic control to manual control so that the pump could be secured and RPV water level could be maintained, a licensed utility operator inadvertently failed to set the manual flow control potentiometer to match the output of the automatic controller prior to the transfer. This failure caused feedwater flow to the RPV to increase and resulted in overfeed of the RPV causing water level in the RPV to approach the Level 8, high water level, scram setpoint.

System operating procedure 3103.01, Feedwater, specifically requires that the manual potentiometer be set to "0" deviation prior to transfer of the control for the TDRFP from automatic to manual.

Following this event, the licensed utility operator identified to his supervision that he inadvertently made the error in transferring the control of the feedwater pump. Since the operator identified and recognized his error, no corrective action was necessary with respect to this specific operator; however, the other shift licensed utility operators were provided with the details of this event including the details of the operator error.

Corrective actions for the difficulties experienced with the MSR reheater system and the feedwater heater system and their vent and drain system prior to the event are discussed in the DESCRIPTION OF EVENT section of this LER.

ANALYSIS OF EVENT

This event is reportable under the provisions of 10CFR50.73(a)(2)(iv) because of the manual initiation of the Reactor Protection System JC!. Assessment of the nuclear safety consequences and implications indicates that this event was not nuclear safety significant. Prompt and correct operator action was taken by initiating a manual scram of the reactor before an automatic scram occurred because of increasing RPV water level. Initiation of the reactor scram placed the plant in a safe condition.

ADDITIONAL INFORMATION

The Normal Drain Valve, 1HD012B, of the "B" RHDT is an 8-inch diameter globe valve, model number 667-EWD manufactured by Fisher Controls Company.

The relief valves, 1DV032A and 1DV032B of the "6B" reactor feedwater high pressure heater are 6-inch by 8-inch relief valves, model number JB-55, manufactured by Crosby Valve and Gage Company. Relief valve 1DV042A of the

"3A" reactor feedwater low pressure heater is a 6-inch by 8-inch relief valve, model number JB-25, manufactured by Crosby Valve and Cage Company.

The controller for the Emergency Drain Valve of the "B" RHDT is a model number 546 electro-pneumatic transducer manufactured by Fisher Controls Company.

The valve positioners for steam supply valves 1B21-RSHLV-1, 1B21-RSLLV-1, and 1B21-RSLLV-2 are model numbers 476D-16-EL.D and 667-ED manufactured by Fisher Controls Company.

No other reactor scrams have been initiated because of a similar cause.

For further information regarding this event, contact D. R. Morris, Director - Plant Operations at (217) 935-8881, extension 3205.

ATTACHMENT 1 TO 8909060289 PAGE 1 OF 1

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L45-89(08-30)-LP
2C.220

ILLINOIS POWER COMPANY IP CLINTON POWER STATION,
P.O. BOX 678,
CLINTON, ILLINOIS 61727

August 30, 1989

10CFR50.73

Docket No. 50-461

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555

Subject: Clinton Power Station - Unit 1
Licensee Event Report No. 89-032-00

Dear Sir:

Please find enclosed Licensee Event Report No. 89-032-00: Failure to Match Manual Control to Automatic Control Prior to Transferring Feedwater Pump to Manual Results in Increase in Reactor Water Level and Manual Scram. This report is being submitted in accordance with the requirements of 10CFR50.73.

Sincerely yours,

D. L. Holtzscher
Acting Manager -
Licensing and Safety

RSF/krm

Enclosure

cc: NRC Resident Office
NRC Region III, Regional Administrator
INPO Records Center
Illinois Department of Nuclear Safety
NRC Clinton Licensing Project Manager

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